Quentin CHANGEAT – French – phone: 0033 6 58 72 94 80 – email: quentin.changeat.18@ucl.ac.uk
Academic website: https://quentchangeat.github.io/ , ORCID: 0000-0001-6516-4493.

Researcher in Astrophysics

RESEARCH SUMMARY:

My research focuses on the analysis of current and future observations of exoplanets, planets outside our solar system, to understand the physics and the chemistry of their atmospheres. Using data-oriented techniques, I am interested in the properties of all planets, ranging from the temperate super-Earth LHS-1140b to the extremely-hot Jupiter KELT-9b, that I observed with the James Webb, Hubble and Spitzer Space Telescopes. I have pioneered in the development of tools (*TauREx3* and *Alfnoor*) adapted to the analysis of large populations of atmospheres and the extraction of their 3D nature from challenging phase-curve observations. I have also used those tools to evaluate the performances of next generation telescopes such as ESA Ariel in answering some of the major questions of the field. My work relies on cross-disciplinary approaches to understand exoplanetary atmospheres. My research contribution from 2019 to now includes 10 first author, 10 second author, and 17 co-authored works, published in high-impact journals (h-index of 16).

CURRENT AND FUTURE POSITION(S):

2022 Sep – 2025:	**European Space Agency Fellow** Space Telescope Science Institute, Baltimore (USA)
2022 May – Current:	**Guest Researcher** Centre for Computing Astrophysics, Flatiron Institute, Simons Foundation (USA)
2021 Jan – Current:	**Postdoctoral Research Fellow** Department of Physics and Astronomy, University College London (UK)
Leadership roles:	Coordinator of the Spectral Retrieval working group for the ESA Ariel Mission. Developer of the *TauREx* and *Alfnoor* exoplanet suites (more than 10000 downloads). Co-PI HST Proposal 16457 (8 orbits) PI CHEOPS Proposal PR230014, co-PI of PR230019, PR230026, PR230029 and PR230034 (331 orbits). External reviewer of HST Cycle 29. Reviewer: ApJ, A&A, JOSS, Exp. Ast., Astrophys. Space Sci.
Press articles:	ESA/UCL/NVIDIA/CNRS press-release: "Hubble observations used to answer key exoplanet questions" ExoClock Ariel articles: "The prospects of phase curve studies in the Ariel era". The Conversation: "AI can reliably spot molecules on exoplanets…". The Conversation: "How can some planets be hotter than stars?". Science & Vie: "Le mystère des planètes vaporeuses". All About Space Magazine: "What are hot-Jupiters?".

EDUCATION:

- 2018-2021: **PhD in Astrophysics -** *University College London* (UK) – Title: Next generation techniques to characterise exoplanetary atmospheres – Supervisor: Prof. Giovanna Tinetti.
  - Thesis finished in 2 years (1 year ahead of schedule).
  - Jon Darius Memorial Prize for best thesis in Astrophysics.
- 2017-2018: **Master (Part III) in Applied Mathematics -** *University of Cambridge* (UK) – E.M. Burnett prize for excellent results.
- 2015-2016: **Master (MSc) in Environmental Technology -** *Imperial College London* (UK) – Grade: Merit
- 2013-2016: **Master (MEng) in General Engineering -** *Ecole des Mines Douai* (FRA) – Ranked top 1%.
- 2010-2013: **CPGE: Equiv. Bachelor Degree in Mathematics/Physics -** *Lycée Daudet* (FRA) – Grade: A

LIST OF PUBLICATIONS:

Summary of research contribution: 10 first author, 10 second authors and 17 co-authored articles published in high impact journals between 2019 and May 2022. Statistics computed on the 16th of May 2022.

ADS list can be accessed at: https://ui.adsabs.harvard.edu/public-libraries/Bt4TNyP4RTOi1UoeyWElYg

Total number of accepted papers: 37 (10 first author)

ADS author h-index: 16
Total number of citations: 641

[1] **Changeat** et al. (2022): Five Key Exoplanet Questions Answered via the Analysis of 25 Hot-Jupiter Atmospheres in Eclipse, *ApJS, 260, 3. doi:10.3847/1538-4365/ac5cc2.*

[2] **Changeat** (2021): On spectroscopic phase-curve retrievals: H2 dissociation and thermal inversion in in the atmosphere of the ultra-hot Jupiter WASP-103 b, *doi:10.3847/1538-3881/ac4475.*

[3] **Changeat** et al. (2021): An exploration of model degeneracies with a unified phase curve retrieval analysis: The light and dark sides of WASP-43 b, *ApJ, 913, 73. doi:10.3847/1538-4357/abf2bb.*

[4] **Changeat** and Edwards (2021): The Hubble WFC3 Emission Spectrum of the Extremely-Hot Jupiter, KELT-9b, *ApJL, 907, L22. doi:10.3847/2041-8213/abd84f.*

[5] **Changeat**, et al. (2021): Disentangling Atmospheric Compositions of K2-18 b with Next Generation Facilities, *Exp. Astron. Ariel Special Edition. doi: 0.1007/s10686-021-09794-w.*

[6] **Changeat**, et al. (2020): KELT-11b: Abundances of water and constraints on carbon-bearing molecules from the Hubble transmission spectrum, *AJ, 160, 260. doi:10.3847/1538-3881/abbe12.*

[7] **Changeat** and Al-Refaie (2020): TauREx3 PhaseCurve: A 1.5D model for phase curve description, *ApJ, 898, 155. doi:10.3847/1538-4357/ab9b82.*

[8] **Changeat**, et al. (2020): Alfnoor: A Retrieval Simulation of the Ariel Target List, *AJ, 160, 80. doi:10.3847/1538-3881/ab9a53.*

[9] **Changeat**, et al. (2020): Impact of planetary mass uncertainties on exoplanet atmospheric retrievals, *ApJ, 896, 107. doi:10.3847/1538-4357/ab8f8b.*

[10] **Changeat**, et al. (2019): Towards a more complex description of chemical profiles in exoplanets retrievals: A 2-layer parameterisation, *ApJ, 886, 39. doi:10.3847/1538-4357/ab4a14.*

[11] Al-Refaie, **Changeat** (2022): A comparison of chemical models of exoplanet atmospheres enabled by TauREx 3.1, *Accepted in ApJ.*

[12] Anisman, et al. (2022): Cross-sections for heavy atmospheres: H2O self-broadening, *JQSRT, 283, 108146. doi:10.1016/j.jqsrt.2022.108146.*

[13] Barstow, **Changeat** et al. (2022): A retrieval challenge exercise for the Ariel mission, *Exp. Astron.. doi:10.1007/s10686-021-09821-w.*

[14] Gressier et al. (2022): Near-infrared transmission spectrum of TRAPPIST-1 h using Hubble WFC3 G141 observations, *A&A, 658, A133. doi:10.1051/0004-6361/202142140.*

[15] Al-Refaie, **Changeat**, et al. (2021): TauREx III: A fast, dynamic and extendable framework for retrievals, *ApJ, 917, 37. doi: 10.3847/1538-4357/ac0252.*

[16] Saba, et al. (2021): The transmission spectrum of WASP-17 b from the optical to the near-infrared wavelengths: combining STIS, WFC3 and IRAC datasets, *Accepted in AJ.*

[17] Anisman, et al. (2021): Cross-sections for heavy atmospheres: H2O continuum, *JQSRT, https://doi.org/10.1016/j.jqsrt.2021.108013.*

[18] Mugnai, et al. (2021): Alfnoor: Assessing the Information Content of Ariel's Low-resolution Spectra with Planetary Population Studies, *AJ, 162, 288. https://doi.org/10.3847/1538-3881/ac2e92*

[19] Tinetti et al. (2021): Ariel: Enabling planetary science across light-years, *Ariel Definition Study Report reviewed by ESA Science Advisory Structure in November 2020, arXiv:2104.04824.*

[20] Mugnai et al. (2021): ARES V: No Evidence For Molecular Absorption in the HST WFC3 Spectrum of GJ 1132 b, *AJ, 161, 284. doi:10.3847/1538-3881/abf3c3.*

[21] Ito, **Changeat,** et al. (2021): Detectability of Rocky-Vapour Atmospheres on Super-Earths with Ariel, *Exp. Astron., https://doi.org/10.1007/s10686-020-09693-6.*

[22] Turrini et al. (2021): Tracing the formation history of giant planets in protoplanetary disks with Carbon, Oxygen, Nitrogen and Sulphur, *ApJ, 909, 40. doi:10.3847/1538-4357/abd6e5.*

[23] Yip, **Changeat**, et al. (2020): Peeking inside the Black Box: Interpreting Deep Learning Models for Exoplanet Atmospheric Retrievals, *Accepted in ApJ - arXiv:2011.11284.*

[24] Edwards, **Changeat**, et al. (2020): Hubble WFC3 Spectroscopy of the Habitable-zone Super-Earth LHS 1140 b, *AJ, 161, 44. doi:10.3847/1538-3881/abc6a5.*

[25] Guilluy et al. (2020): ARES IV: Probing the atmospheres of the two warm small planets HD 106315 c and HD 3167 c with the HST/WFC3 camera, *AJ, 161, 19. doi:10.3847/1538-3881/abc3c8.*

[26] Yip, **Changeat**, et al. (2020): On the Compatibility of Ground-based and Space-based Data: WASP-96 b, An Example, *AJ, 161, 4. doi:10.3847/1538-3881/abc179.*

[27] Anisman et al. (2020): WASP-117 b: an eccentric hot-Saturn as a future complex chemistry laboratory, *AJ, 160, 233. doi:10.3847/1538-3881/abb9b0.*

[28] Edwards, Anisman, et al. (2020): Original Research By Young Twinkle Students (ORBYTS): Ephemeris Refinement of Transiting Exoplanets II, *RNAAS, 4, 109. doi:10.3847/2515-5172/aba42b.*

[29] Pluriel et al. (2020): ARES III: Unveiling the Two Faces of KELT-7 b with HST WFC3, *AJ, 160, 112. doi:10.3847/1538-3881/aba000.*

[30] Skaf et al. (2020): ARES II: Characterising the Hot Jupiters WASP-127 b, WASP-79 b and WASP-62 b with HST, *AJ, 160, 109. doi:10.3847/1538-3881/ab94a3.*

[31] Edwards, **Changeat**, et al. (2020): ARES I: WASP-76 b, A Tale of Two HST Spectra, *AJ, 160, 8. doi:10.3847/1538-3881/ab9225.*

[32] Edwards, **Changeat**, et al. (2020): Original Research By Young Twinkle Students (ORBYTS): Ephemeris Refinement of Transiting Exoplanets, *MNRAS, 504, 4. doi:10.1093/mnras/staa1245.*

[33] Bourgalais, Carrasco, et al. (2020): Ions in the Thermosphere of Exoplanets: Observable Constraints Revealed by Innovative Laboratory Experiments, *ApJ, 895, 77. doi:10.3847/1538-4357/ab8e2d.*

[34] Barstow, **Changeat**, et al. (2020): A comparison of exoplanet spectroscopic retrieval tools, *MNRAS, 493, 4884. doi:10.1093/mnras/staa548.*

[35] Drummond et al. (2020): Implications of three-dimensional chemical transport in hot Jupiter atmospheres: results from a consistently coupled chemistry-radiation-hydrodynamics model, *A&A, 636, A68. doi:10.1051/0004-6361/201937153.*

[36] Venot et al. (2020): Global Chemistry and Thermal Structure Models for the Hot Jupiter WASP-43b and Predictions for JWST, *ApJ, 890, 176. doi:10.3847/1538-4357/ab6a94.*

[37] Yip et al. (2020): Pushing the Limits of Exoplanet Discovery via Direct Imaging with Deep Learning, *ECML-PKDD 2019. doi:10.1007/978-3-030-46133-1_20.*

INTERNATIONAL COLLABORATIONS:

- **Flatiron Institute, Simons Foundation** - New York (USA): Collaboration with Prof. J. Cho group as part of the joint-project "Planetary atmospheres are not 1D".
- **NASA Jet Propulsion Lab (JPL)** – Pasadena (USA): Collaboration with Prof. M. Swain in the Cross-Spec team and the Ariel Mission.
- **Tokyo University** – Tokyo (JP): Collaboration with Prof. M. Ikoma in a number of planetary formation studies and creation of the UCT (University College Tokyo) research group.
- **Institute of Astrophysics Paris (IAP)** – Paris (FR): Collaboration with Prof. J-P. Beaulieu and P. Drossart for the ARES schools.
- **Centre à l'Energie Atomique (CEA)** – Paris (FR): Collaboration with Prof. P-O. Lagage for the Ariel and JWST missions.
- **Laboratoire Inter-universitaire des Systèmes Atmosphériques (LISA)** – Paris (FR): Collaboration with Dr. O. Venot for the EXACT (EXoplanetary Atmospheric Chemistry at high Temperature) project and in a number of chemistry related studies.
- **Sapienza University** – Rome (IT): Collaboration with Prof. E. Pascale group for the Ariel mission and the development of *Alfnoor*.
- **Italian National Astrophysics Institute (INAF)** – Rome (IT): Collaboration with Prof. D. Turrini to build a bridge between planetary formation and exoplanet atmospheric studies.
- **Palermo Observatory** – Palermo (IT): Collaboration with Prof. Micela on stellar monitoring and interactions star-planets.
- **University of Edinburgh** – Edinburgh (UK): Collaboration with Edinburgh to apply retrievals to directly imaged exoplanets.

SELECTION OF INVITED AND CONFERENCE TALKS:

- Invited talk at **NASA Jet Propulsion Lab** (USA) – Aug 2022.
- Invited talk at the **Tokyo University** (JP) – Feb 2022.
- Invited talk at **NASA Goddard Space Flight Center** (Virtual) – Dec 2021.
- Invited talk at the **Exosystèmes II** conference (France) – Dec 2021.
- Invited talk at the **Ariel ARES days** (Virtual) – Dec 2020.
- Invited talk at the **Tokyo University** (JP) – Mar 2020.
- Conference talk at the **Rocky Exo-worlds Conference** in Cambridge (UK) – Jan 2020.
- Invited talk at the **Tokyo University** (JP) – Oct 2019.
- Conference talk at the **EPSC-DPS 2019** conference in Lyon (FR) – Sep 2019.
- Invited talk at the **University of California Berkeley** (USA) – Jul 2019.
- Invited talk at the **NASA Jet Propulsion Lab** (USA) – Jul 2019.
- Invited talk at the **California Institute of Technology** (USA) – Jul 2019.
- Conference talks in **about 15 other events,** including ESA Ariel Consortium meetings (Europe locations) – 2018 to Present.

PUBLIC EVENTS:

- Invited public talk for the **Pint of Science** (Paris) – May 2022.
- Invited public talk for the **Astronomines Conference** (Online) at Ecole des Mines Saint-Etienne – Dec 2020.
- Invited public talks for the **Conférence Astronomie** at Lycée Jacque Prévert and Saint-Christol-les-Ales (3 talks: open to all, reserved for students, for literature students) – Nov 2019.
- Invited public talk for the **Space Cafe** in Tokyo – Oct 2019.

TEACHING:

- **Invited lecturer** at the Rencontre Exobiologique pour Doctorants (RED 22) school – Mar 2022.
- **Student Supervision:** Supervision and co-supervision of 3 PhD and 9 MSc students - 2019 to Present.
- **Organisation of a TauREx hands-on workshop** for Exosystèmes II in Toulouse – Dec 2021.
- **Teaching to about 20 PhD/PostDocs** at the ARES I and ARES II Summer Schools (Organising Committee) – Sep 2019 and 2021.
- **Organisation of a TauREx 2h-tutorials** for the Digital Exoplanets conference in Prague – Feb 2019.
- **Marking of coursework and exams** for the UCL Exoplanet course – 2018 to 2019 cohorts.
- **Teaching exoplanet science to high school student** as part of the ORBYTS program. Planification of observations with the LCO and TelescopeLive networks to characterise ephemerids of transiting planets. Two publications – 2018 to 2020.

FELLOWSHIPS:

- ESA Research Fellowship – Jan 2022.
- JSPS Short-Term Postdoctoral Research Fellowship at NAOJ in Japan – Apr 2021.
- UKSA Postdoctoral Research Fellowship at University College London – Jan 2021.
- PhD fellowship for 3.5 years at University College London – Oct 2018.

PRIZES AND BURSARY AWARDS:

Prizes:
- Prize for the best thesis in Astrophysics (J. Darius Memorial Prize) from UCL – Oct 2021.
- Prize in recognition of excellent results (E.M. Burnett) from University of Cambridge – Oct 2018.

Bursary and awards:
- MAPS Early Career Grant from UCL – May 2022.
- Funding to teach at the Biarritz Summer School from CNES – Sep 2019.
- Bursary from NASA/MIT to attend the TESS conference at MIT – Aug 2019.
- Bursary from NASA to attend the Sagan Summer School at Caltech – Aug 2019.
- Grant from UCL (UCL Cities Partnership) for travel to Paris and Rome collaborations – Jul 2019.
- Bursary from Europlanet to participate to the ASES3 Summer School in Vietri – May 2019.
- Bursary from ESA to attend the Ladybird training course – Oct 2019.
- Bursary from Ecole des Mines to support the double degree with Imperial College London – Dec 2015.

OTHER PROFESSIONAL EXPERIENCES:

- 2016 Oct – 2017 Sep: **Consultant in IT at Wavestone** (Paris, FRA)
Assisting in designing the new IT system of Alstom by providing cybersecurity advices, assessing IT operations (flow openings, VPN configurations, security exceptions) and more generally by contributing to their IT migration.

- 2015 Nov - 2016 Feb**: Freelance Consultant in Aerospace at OutSmart Insights Ltd** (London, UK)
Technology scanning and advises for an aerospace company (BAE Systems). Identification of key technologies, their applications, their Technology Readiness Level (TRL) and their patents for jet aircrafts.